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(71)Applicant : DIGITAL ELECTRON CORP

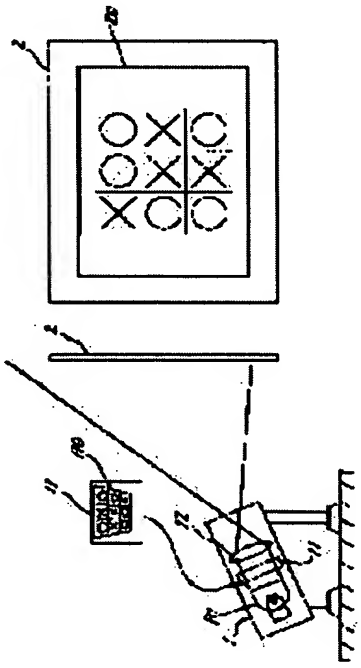
(72)Inventor : MAEKAWA TOSHIYUKI

(54) METHOD FOR CORRECTING DISTORTION OF IMAGE PROJECTED BY, PROJECTOR AND PROJECTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To correct the distortion of an image projected in a screen without adding an optical system for a projection-type display.

SOLUTION: In the projector 1 which enlarges and displays the image 110 displayed on a light bulb 11 on the screen 2, picture elements from which image information are omitted and picture elements to which remaining picture information are filled and displayed in the light bulb 11 are previously stored so that the magnification rate of the image 20 becomes uniform in the respective parts of the screen 2. Image information of the pixels to be omitted are omitted from original images and the remaining images are displayed on the displayed pixels in the light bulb 11.



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CLAIMS

[Claim(s)]
[Claim 1] In the projector (1) which carries out the enlarged display of the image (110) displayed on the light valve (11) to a screen (2), so that the dilation ratio of an image (20) may become uniform in each part of a screen (2) The pixel from which image information is excluded about each pixel in a light valve (11), How to amend distortion of the projector projection image which memorizes beforehand the pixel as which the remaining image information is packed and displayed, excludes said image information of a pixel excluded from a subject-copy image, and displays the remaining image in said pixel in a light valve (11) displayed.
[Claim 2] In the projector (1) which carries out the enlarged display of the image (110) displayed on the light valve (11) to a screen (2), so that the dilation ratio of an image (20) may become uniform in each part of a screen (2) A means to memorize beforehand the pixel from which image information is excluded, and the pixel as which the remaining image information is packed and displayed about each pixel in a light valve (11), A projector equipped with a means to display the image which remained without being excluded by means to exclude the image information in said pixel which was read from a this means to memorize, and which is excluded from a subject-copy image, and this **** means on said pixel in the light valve (11) read from said means to memorize displayed.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the projector for projecting the image data from a computer etc. on a large-sized screen. Specifically, this invention relates to the approach and projector equipment which amend distortion of the image which a projector projects.
[0002]
[Description of the Prior Art] A projector (1) carries out the enlarged display of the image with which the beam of light projected from the light source (10) of a metal halide lamp etc. was displayed on the light valve (11) by passing or reflecting light valves (11), such as a liquid crystal panel, and being expanded through the optical system (12) of an optical lens etc. to a screen (2) like drawing 7 . In order that the dilation ratio of an image may make it abbreviation homogeneity in each part of a screen (2), a projector (1) is arranged to a screen (2) so that the optical axis of a projector (1) may cross the core and perpendicular of a screen (2). However, the projector (1) of a front projection mold will be arranged near the center section of screen (2) this side, and becomes obstructive seeing the image of a screen (2).
[0003]
[Problem(s) to be Solved by the Invention] In order to solve this trouble, like drawing 8 , the location of a projector (1) is arranged down [before a screen (2)], and projecting the beam of light from a projector (1) on the screen (2) located in the slanting upper part is performed. However, since an optical path becomes long rather than the beam of light with which the beam of light projected on the upper part of a screen (2) in this case was projected on the lower part of a screen (2), the image (20) reflected in a screen (2) turns into an image which the upper part was expanded and was distorted to the trapezoid like drawing 8 . Therefore, an image becomes hard to see and, occasionally there is un-arranging [which the upper part of an image protrudes from a screen (2)]. The distortion of the image on such a screen (2) originates in the dilation ratios of the image in each part of a screen (2) differing, as a result of the optical path lengths from a projector (1) differing. Therefore, what is necessary is just to make the dilation ratio of the image in each part of a screen (2) into homogeneity with a certain means, in order to amend distortion of the image on a screen (2). However, in order to perform such distortion amendment in optical system, it is necessary to add special optical system, and a miniaturization or cheap-izing of a projector (1) becomes difficult.
[0004]
[Objects of the Invention] The image distorted to said trapezoid can display the image as the time of arranging a projector in the center section with it on a screen (2) like drawing 1 . [same if the image itself displayed on a light valve (11) is amended beforehand] Namely, about the subject-copy image displayed on a light valve (11), since the image which reversed the upper and lower sides and right and left is displayed on a screen (2), the image of a light valve (11) should just display the image which compressed the subject-copy image and was made small on a light valve (11) as it goes below. This invention aims at offering the approach and equipment which amend distortion of the image on a screen (2), without adding optical system by displaying the image amended beforehand on a light valve (11).

[0005]
[The approach for solving a technical problem] In order to solve the above-mentioned technical problem, the approach of this invention which amends distortion of a projector projection image It is related with each pixel in a light valve so that the dilation ratio of an image may become uniform in each part of a screen. The pixel from which image information is excluded, and the pixel as which the remaining image information is packed and displayed are memorized beforehand, said image information of a pixel excluded is excluded from a subject-copy image, and the remaining image is displayed in said pixel in a light valve displayed.
[0006]
[Function] A subject-copy image will be compressed by excluding the image information of a pixel which should be excluded from a subject-copy image, packing the remaining image and being displayed on a light valve by the above-mentioned approach. therefore, when the image on a screen is distorted to a trapezoid by having arranged the projector (1) in the lower part like drawing 8 When the pixel from which image information should be excluded, and the pixel which the remaining image information should be packed and should be displayed on a light valve (11) are memorized so that a subject-copy image may be compressed as it goes below, like drawing 1 The image displayed on a light valve (11) turns into an image compressed as it went caudad, and an image to which the subject-copy image was expanded as it was is displayed on a screen (2).
[0007]
[Effect of the Invention] Since this invention performs distortion amendment of an image in an electrical circuit, it does not need the optical system of the addition for distortion amendment. Therefore, enlargement and forming an expensive rank do not have a projector for distortion amendment of an image.
[0008]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained in full detail along with a drawing. The enlarged display of the image on a light valve (11) is carried out to a screen (2) by the beam of light projected from the light source (10) of a metal halide lamp like drawing 1 passing the light valve (11) constituted with a transparency mold liquid crystal panel, and expanding a projector (1) through the optical system (12) constituted with an optical lens. The power source for the light sources (30) which makes the light source (10) turn on is connected to this projector (1) like drawing 2 . Moreover, based on the horizontal synchronizing pulse, vertical synchronizing pulse, and picture signal which were received, a light valve (11) is driven to a light valve (11), and the display driving gear (31) which displays an image on a light valve (11) is connected to it. In order to amend the keystone distortion of the image displayed on a screen (2), the picture signal from a personal computer (4) is amended in a display driving gear (31), and the trapezoidal-distortion compensator (5) which transmits the amended picture signal to a display driving gear (31) is connected to it.
[0009] The circuitry of said trapezoidal-distortion compensator (5) is explained along with drawing 3 and drawing 4 . Like drawing 3 , the trapezoidal-distortion compensator (5) in this operation gestalt amends the picture signal from a personal computer (4), and is equipment which memorizes the amended picture signal to DRAM (dynamic random access memory) (6), reads the picture signal memorized like drawing 4 from DRAM (6), and is transmitted to a display driving gear (31).
[0010] First, a picture signal, a horizontal synchronizing pulse, and a vertical synchronizing pulse are received from a personal computer (4). The picture signal from a personal computer (4) is an analog signal, the picture signal of the 1 scanning line is transmitted within a horizontal synchronization period, and the picture signal of one screen is transmitted by repeating this within a vertical-synchronization period. In order to amend a picture signal and to memorize to DRAM (6), the A/D converter (70) which changes the picture signal of an analog into a digital signal is arranged by the trapezoidal-distortion compensator (5).
[0011] An A/D converter (70) measures the picture signal of the 1 scanning line with a fixed time interval by sampling, quantization which changes this measured value into a numeric value is performed, and, finally digitization of an analog signal is performed by coding which changes this quantized numeric value into a binary number. However, transmission is started from the time of

not being transmitted to throughout [whole term / of the pulse separation A of a horizontal synchronizing pulse] like drawing 6 , but the picture signal of the 1 scanning line having passed the predetermined period B (called the back porch) since the initiation time a of the pulse separation A, and transmission is ended only for the predetermined period C (called the front porch) from b at the last time at the termination time of the pulse separation A. Therefore, an A/D converter (70) needs to sample a picture signal at the image display period D excluding the front porch B and the back porch C from the pulse separation A of a horizontal synchronizing pulse.

[0012] Then, in drawing 3 , a write-in initiation pulse forming network (71) receives a horizontal synchronizing pulse, specifies an image display initiation time, generates a write-in initiation pulse (710) based on this time, and transmits it to a write-in clock generation circuit (72). A write-in clock generation circuit (72) receives said write-in initiation pulse (710), and generates a write-in clock (720) with which the picture signal of the 1 scanning line is divided into the number of pixels (this example 16 pixels per 1 scanning line) of a request of a light valve (11) by sampling. An A/D converter (70) receives the write-in clock (720) from said write-in clock generation circuit (72) with a clock terminal, a picture signal is digitized based on this write-in clock (720), and the digitized picture signal is transmitted to DRAM (6).

[0013] In case a digital picture signal is written in DRAM (6), it is necessary to specify the address which shows a write-in location. With this operation gestalt, the image from a personal computer (4) is monochrome 2 gradation, is divided into 16 pixels per 1 scanning line, and is performed about the case where one screen is constituted by the 12 scanning lines. Since the image information of each pixel is expressed by the 1-bit digital signal with an A/D converter (70) at this time, memory capacity required for DRAM (6) becomes 16x12x1=192 bit. Moreover, the location of the pixel of one screen is pinpointed by the 4 bits line address which pinpoints the scanning-line location in 1 screen, and the 4-bit train address which pinpoints the pixel location in 1 scanning line. Since a line address is specified, a line counter (73) is arranged. A line counter (73) receives a horizontal synchronizing pulse with a clock terminal, receives a vertical synchronizing pulse with a reset terminal, and transmits a 4-bit line address signal. Moreover, since the train address is specified, a dot counter (74) is arranged. A dot counter (74) receives the write-in clock (720) from a write-in clock generation circuit (72) with a clock terminal, receives a horizontal synchronizing pulse with a reset terminal, and transmits a 4-bit train address signal. What is necessary is for a DRAM controller (60) to receive the line address signal and train address signal from a line counter (73) and a dot counter (74), and just to write a digital picture signal in the line address and the train address in DRAM (6) which were received, if the image on a light valve (11) is projected to a screen (2) as it is without amending distortion of an image.

[0014] The approach of amending the trapezoidal distortion of an image in this operation gestalt is as follows. What is necessary is just to compress an image about the image displayed on a screen (2) as it goes upwards in order to amend the trapezoidal distortion of an image (20) like drawing 8 . Therefore, like drawing 5 (c), a subject-copy image like drawing 5 (a) should just use the image (110) displayed on a light valve (11) as the image which compressed the image to the center section as it goes caudad. What is necessary is to exclude all the image information of a certain Rhine in the lower part which needs to make compressibility high, and just to pack Rhine which remained upwards about a perpendicular direction, that what is necessary is to enlarge the rate of it being related horizontally, excluding image information suitably per pixel like drawing 5 (b), and excluding more downward Rhine, and just to bring near the remaining image by the center section in order to realize this with a digital signal. In addition, in drawing 5 (b), the written location of a figure shows each pixel and, as for the thing of 0, the numeric value shows that the image information of the pixel of the location is excluded.

[0015] If it is the case of drawing 5 (b), therefore, from a top the image of the 1st line and the 2nd line Only the image information of the pixel of both ends is excluded. The image of the 3rd line The image information of the pixel of eye nine trains is excluded from both ends and Hidari, the number of pixels of the image of the 4th line which the image information of the pixel of eye eight trains is excluded from both ends and Hidari, and is hereafter excluded as it goes caudad

increases, and all the image information of the pixel of the 8th line and the 12th line is further excluded from a top. Since the remaining image is brought near by the center section and packed upwards, moreover, −1 line image of the 2nd line It is displayed on eye eye two trains − 15 train. −3 line image of the 4th line It is displayed on eye eye two trains − 14 train. −5 line image of the 6th line It is displayed on eye eye three trains − 14 train. −7 line image It is displayed on eye eye three trains − 13 train, −9 line image is displayed on eye eye 3 of the 8th line trains − 13 train, −10 line image is displayed on eye eye 4 of the 9th line trains − 13 train, and −11 line image is displayed on eye eye 4 of the 10th line trains − 13 train.
The pixel which should be excluded can be chosen as arbitration at this time. However, since information important for a center section contains image information, it is usually desirable to exclude the edge of an image preferentially. Moreover, in order to prevent all the image information of a certain part being missing, it is desirable to exclude an image equally, without inclining.
[0016] In order to realize the above−mentioned amendment approach, ROM for dot amendment (read only memory) (75) which memorized the information on whether image information is excluded about each pixel like drawing 5 (b), and ROM for address amendment (76) which memorized the initiation train of each line are arranged. ROM for dot amendment (75) receives the line address signal from a line counter (73), and the train address signal from a dot counter (74), reads the corresponding data of a location, and transmits them as a write−in enabling signal. At this time, if these data are 1, the signal of H level which shows write−in authorization will be transmitted, and if data are 0, the signal of L level which shows a write inhibit will be transmitted. ROM for address amendment (76) receives the line address signal from a line counter (73), reads the initiation train address corresponding to this line address, and transmits a line address and the initiation train address to the address counter for writing (77).
[0017] The address counter for writing (77) receives the line address and the initiation train address from ROM for address amendment (76) as initial value of a counter. Moreover, the write−in clock (720) from a write−in clock generation circuit (72) and the write−in enabling signal from ROM for dot amendment (75) are received, an AND is taken, and the AND gate (78) is transmitted to the clock terminal of the address counter for writing (77). And the address counter for writing (77) transmits the write−in address to a DRAM controller (60). A DRAM controller (60) memorizes the write−in enabling signal from ROM for dot amendment (75), and the 1−pixel picture signal digitized in DRAM (6) by the storage location corresponding to the write−in address only when the write−in address from the address counter for writing (77) was received and a write−in enabling signal was H level.
[0018] The actuation when receiving the picture signal, horizontal synchronizing pulse, and vertical synchronizing pulse for one screen in the circuit of the above−mentioned configuration is explained. First, a line counter (73) is reset by reception of a vertical synchronizing pulse. Next, a line counter (73) counts by reception of a horizontal synchronizing pulse, and a dot counter (74) is reset. Moreover, based on the time of starting the display of an image after reception of a horizontal synchronizing pulse, a write−in initiation pulse forming network (71) generates a write−in initiation pulse (710), and a write−in clock generation circuit (72) receives this write−in initiation pulse (710), and starts generation of a write−in clock (720). An A/D converter (70) is sampled and digitized by the number of pixels of a request of the picture signal of the 1 scanning line (this operation gestalt 16) based on this write−in clock (720). Moreover, a dot counter (74) counts based on this write−in clock (720). ROM for address amendment (76) receives the line address signal from a line counter (73), and transmits the corresponding initiation train address of a line to the address counter for writing (77). Moreover, ROM for dot amendment (75) receives the line address signal and train address signal from a line counter (73) and a dot counter (74), respectively, from the address position to which this ROM (75) corresponds, reads the information on whether image information is excluded, and transmits a write−in enabling signal. An AND with the write−in clock (720) from a write−in clock generation circuit (72) is taken, and, as for a write−in enabling signal, the signal of this AND is transmitted to the address counter for writing (77) in the AND gate (78). The address counter for writing (77) starts a count from the line address and the initiation train address from ROM for address amendment (76), and

counts it based on the signal of the AND of a write-in clock (720) and a write-in enabling signal. That is, when image information is excluded, it does not count. And a DRAM controller (60) memorizes the 1-pixel picture signal digitized by the storage location of the write-in address in DRAM (6), only when a write-in enabling signal is H level.
[0019] Next, the image which the trapezoidal distortion was amended and was memorized by DRAM (6) is explained along with drawing 4 about the circuitry for transmitting to a display driving gear (31). A horizontal synchronizing pulse and a vertical synchronizing pulse need to be transmitted to a display driving gear (31) with a picture signal. Therefore, the display controller (80) who generates a horizontal synchronizing pulse and a vertical synchronizing pulse is stationed. Moreover, like the above, a horizontal synchronizing pulse is received, an image display initiation time is specified, and this read-out initiation pulse forming network (81) that generates a read-out initiation pulse (810), and is transmitted based on a time is arranged. Moreover, the read-out clock generation circuit (82) which generates the read-out clock (820) corresponding to the number of pixels (this operation gestalt 16) which should be read to per 1 scanning line is arranged like the above by receiving the read-out initiation pulse (810) from a read-out initiation pulse forming network (81).
[0020] In case the 1-pixel picture signal digitized from DRAM (6) is read, it is necessary to specify the line address and the train address which show a read-out location. Therefore, the line counter (83) which specifies a line address, and the dot counter (84) which specifies the train address are arranged. A line counter (83) receives the horizontal synchronizing pulse and vertical synchronizing pulse from a display controller (80) with a clock terminal and a reset terminal, respectively, and transmits a 4-bit line address signal to a DRAM controller (60). A dot counter (84) receives the read-out clock (820) from a read-out clock generation circuit (82) with a clock terminal, receives the horizontal synchronizing pulse from a display controller (80) with a reset terminal, and transmits a 4-bit train address signal to a DRAM controller (60).
[0021] A DRAM controller (60) receives said read-out clock (820), a line address signal, and a train address signal, and a 1-pixel picture signal is read from the storage location of DRAM (6) specified by a line address signal and the train address signal based on a read-out clock (820). Since the read picture signal is a digital signal, the D/A converter (85) which changes this into an analog signal is arranged. The picture signal read from DRAM (6) is changed into a D/A converter (85) by the analog signal based on a read-out clock (820), and by covering the line address of one line and repeating this, it serves as a picture signal of the 1 scanning line, and is transmitted to a display driving gear (31) with the horizontal synchronizing pulse and vertical synchronizing pulse from a display controller (80).
[0022] By constituting a trapezoidal-distortion compensator (5) as mentioned above, the image from a personal computer (4) is received, and it is made the image which amended the trapezoidal distortion beforehand, and memorizes to DRAM (6). And the image which amended the trapezoidal distortion projects on a light valve (11) like drawing 1 by reading the image amended from DRAM (6) and transmitting to a display driving gear (31) with a horizontal synchronizing pulse and a vertical synchronizing pulse. Therefore, the legible image with which the trapezoidal distortion was amended is projected on a screen (2) like drawing 1 . Thus, since this invention amends a trapezoidal distortion in the electrical circuit of a trapezoidal-distortion compensator (5), it does not need the optical system of the addition for keystone correction. Therefore, enlargement and forming an expensive rank do not have a projector (1) for keystone correction.
[0023] In addition, in order to give explanation easy, although [this operation gestalt] one screen is constituted by 12 x 16 pixels, the number of pixels which constitutes one screen can be chosen as arbitration. It is necessary to change the memory space of DRAM (6) according to the number of pixels at this time. Similarly, with this operation gestalt, although the monochrome image was explained, this is applicable also to a color picture. Since a picture signal is constituted by three picture signals, R (red), G (green), and B (blue), at this time, it is necessary to increase the memory space of DRAM (6) 3 times. Moreover, it is necessary to arrange three light valves (11) for every picture signal, to compound the beam of light which passes each light valve (11) with a well-known means, and to project on a screen (2). Similarly, with this operation

gestalt, although the picture signal was made into 2 gradation, it is applicable also to the picture signal which has halftone. It is necessary to increase the quantum numbers in quantization of an A/D converter (70), and the memory space of DRAM (6) according to the number of gradation at this time.

[0024] for example, like the common VGA display of a personal computer (4) One screen is constituted by 480 x 640 pixels, and the RGB code in each pixel 6-bit 64 gradation When receiving the picture signal which is (that is, 643** 260,000 color can be displayed) from a personal computer (4) When 23x3=24 bit is needed about each pixel and this is made into 1 word, 210x29=512K WORD (referred to as 1K=1024) is needed about one screen. Therefore, DRAM (6) whose memory space is 512K WORD x24 bit will be used in this case.

[0025] Moreover, although this operation gestalt has explained the keystone distortion of an image from the projector (1) as an extreme example [image / which is projected on a screen (2)] of distortion Even if it is the case where an optical axis from a projector (1) like drawing 7 crosses the core and perpendicular of a screen (2), the optical path length from a projector (1) The core of a screen (2) is the shortest, and since the four corners of a screen (2) become the longest, the image displayed on a screen (2) turns into the so-called image of a bobbin strain. This bobbin strain can be amended by applying this invention and displaying on a light valve (11) the image in which the image of four corners was compressed and put from the subject-copy image also about the image of this bobbin strain. Thus, this invention is applicable to distortion of the arbitration of the image projected on a screen (2).

[0026] Moreover, with this operation gestalt, ROM for dot amendment (75) and one ROM for address amendment (76) were arranged at the trapezoidal-distortion compensator (5), respectively. However, the dilation ratio of the image in each part, distortion (2), i.e., the screen, of an image, changes with geometric physical relationship of projectors (1), such as an include angle of a projector (1), the distance of a screen (2) and the optical axis from a projector (1), and the normal of a screen (2) to make, and a screen (2). Therefore, as for the equipment which amends distortion of an image, it is desirable that it has two or more ROMs for dot amendment (75) and ROM for address amendment (76) corresponding to each distortion, and can be made to carry out change use. The equipment which amends distortion of an image or instead of each ROM for amendment (75), and (76) Have RAM for dot amendment, and RAM for address amendment, and the dilation ratio of the image in each part of a screen (2) is computed from the geometric physical relationship of a projector (1) and a screen (2). It is desirable to memorize each data for amendment which created and created the data for dot amendment and the data for address amendment based on the computed dilation ratio to each RAM for amendment, respectively.

[0027] Explanation of the above-mentioned operation gestalt is for explaining this invention, and it should not be understood so that invention of a publication may be limited to a claim or the range may be ****(ed). Moreover, as for each part configuration of this invention, it is needless to say for deformation various by technical within the limits given not only in the above-mentioned operation gestalt but a claim to be possible.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the projector for projecting the image data from a computer etc. on a large-sized screen. Specifically, this invention relates to the approach and projector equipment which amend distortion of the image which a projector projects.

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PRIOR ART

[Description of the Prior Art] A projector (1) carries out the enlarged display of the image with which the beam of light projected from the light source (10) of a metal halide lamp etc. was displayed on the light valve (11) by passing or reflecting light valves (11), such as a liquid crystal panel, and being expanded through the optical system (12) of an optical lens etc. to a screen (2) like drawing 7 . In order that the dilation ratio of an image may make it abbreviation homogeneity in each part of a screen (2), a projector (1) is arranged to a screen (2) so that the optical axis of a projector (1) may cross the core and perpendicular of a screen (2). However, the projector (1) of a front projection mold will be arranged near the center section of screen (2) this side, and becomes obstructive seeing the image of a screen (2).

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EFFECT OF THE INVENTION

[Effect of the Invention] Since this invention performs distortion amendment of an image in an electrical circuit, it does not need the optical system of the addition for distortion amendment. Therefore, enlargement and forming an expensive rank do not have a projector for distortion amendment of an image.
[0008]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained in full detail along with a drawing. The enlarged display of the image on a light valve (11) is carried out to a screen (2) by the beam of light projected from the light source (10) of a metal halide lamp like drawing 1 passing the light valve (11) constituted with a transparency mold liquid crystal panel, and expanding a projector (1) through the optical system (12) constituted with an optical lens. The power source for the light sources (30) which makes the light source (10) turn on is connected to this projector (1) like drawing 2 . Moreover, based on the horizontal synchronizing pulse, vertical synchronizing pulse, and picture signal which were received, a light valve (11) is driven to a light valve (11), and the display driving gear (31) which displays an image on a light valve (11) is connected to it. In order to amend the keystone distortion of the image displayed on a screen (2), the picture signal from a personal computer (4) is amended in a display driving gear (31), and the trapezoidal-distortion compensator (5) which transmits the amended picture signal to a display driving gear (31) is connected to it.
[0009] The circuitry of said trapezoidal-distortion compensator (5) is explained along with drawing 3 and drawing 4 . Like drawing 3 , the trapezoidal-distortion compensator (5) in this operation gestalt amends the picture signal from a personal computer (4), and is equipment which memorizes the amended picture signal to DRAM (dynamic random access memory) (6), reads the picture signal memorized like drawing 4 from DRAM (6), and is transmitted to a display driving gear (31).
[0010] First, a picture signal, a horizontal synchronizing pulse, and a vertical synchronizing pulse are received from a personal computer (4). The picture signal from a personal computer (4) is an analog signal, the picture signal of the 1 scanning line is transmitted within a horizontal synchronization period, and the picture signal of one screen is transmitted by repeating this within a vertical-synchronization period. In order to amend a picture signal and to memorize to DRAM (6), the A/D converter (70) which changes the picture signal of an analog into a digital signal is arranged by the trapezoidal-distortion compensator (5).
[0011] An A/D converter (70) measures the picture signal of the 1 scanning line with a fixed time interval by sampling, quantization which changes this measured value into a numeric value is performed, and, finally digitization of an analog signal is performed by coding which changes this quantized numeric value into a binary number. However, transmission is started from the time of not being transmitted to throughout [whole term / of the pulse separation A of a horizontal synchronizing pulse] like drawing 6 , but the picture signal of the 1 scanning line having passed the predetermined period B (called the back porch) since the initiation time a of the pulse separation A, and transmission is ended only for the predetermined period C (called the front porch) from b at the last time at the termination time of the pulse separation A. Therefore, an A/D converter (70) needs to sample a picture signal at the image display period D excluding the

front porch B and the back porch C from the pulse separation A of a horizontal synchronizing pulse.
[0012] Then, in drawing 3 , a write-in initiation pulse forming network (71) receives a horizontal synchronizing pulse, specifies an image display initiation time, generates a write-in initiation pulse (710) based on this time, and transmits it to a write-in clock generation circuit (72). A write-in clock generation circuit (72) receives said write-in initiation pulse (710), and generates a write-in clock (720) with which the picture signal of the 1 scanning line is divided into the number of pixels (this example 16 pixels per 1 scanning line) of a request of a light valve (11) by sampling. An A/D converter (70) receives the write-in clock (720) from said write-in clock generation circuit (72) with a clock terminal, a picture signal is digitized based on this write-in clock (720), and the digitized picture signal is transmitted to DRAM (6).
[0013] In case a digital picture signal is written in DRAM (6), it is necessary to specify the address which shows a write-in location. With this operation gestalt, the image from a personal computer (4) is monochrome 2 gradation, is divided into 16 pixels per 1 scanning line, and is performed about the case where one screen is constituted by the 12 scanning lines. Since the image information of each pixel is expressed by the 1-bit digital signal with an A/D converter (70) at this time, memory capacity required for DRAM (6) becomes 16x12x1=192 bit. Moreover, the location of the pixel of one screen is pinpointed by the 4 bits line address which pinpoints the scanning-line location in 1 screen, and the 4-bit train address which pinpoints the pixel location in 1 scanning line. Since a line address is specified, a line counter (73) is arranged. A line counter (73) receives a horizontal synchronizing pulse with a clock terminal, receives a vertical synchronizing pulse with a reset terminal, and transmits a 4-bit line address signal. Moreover, since the train address is specified, a dot counter (74) is arranged. A dot counter (74) receives the write-in clock (720) from a write-in clock generation circuit (72) with a clock terminal, receives a horizontal synchronizing pulse with a reset terminal, and transmits a 4-bit train address signal. What is necessary is for a DRAM controller (60) to receive the line address signal and train address signal from a line counter (73) and a dot counter (74), and just to write a digital picture signal in the line address and the train address in DRAM (6) which were received, if the image on a light valve (11) is projected to a screen (2) as it is without amending distortion of an image.
[0014] The approach of amending the trapezoidal distortion of an image in this operation gestalt is as follows. What is necessary is just to compress an image about the image displayed on a screen (2) as it goes upwards in order to amend the trapezoidal distortion of an image (20) like drawing 8 . Therefore, like drawing 5 (c), a subject-copy image like drawing 5 (a) should just use the image (110) displayed on a light valve (11) as the image which compressed the image to the center section as it goes caudad. What is necessary is to exclude all the image information of a certain Rhine in the lower part which needs to make compressibility high, and just to pack Rhine which remained upwards about a perpendicular direction, that what is necessary is to enlarge the rate of it being related horizontally, excluding image information suitably per pixel like drawing 5 (b), and excluding more downward Rhine, and just to bring near the remaining image by the center section in order to realize this with a digital signal. In addition, in drawing 5 (b), the written location of a figure shows each pixel and, as for the thing of 0, the numeric value shows that the image information of the pixel of the location is excluded.
[0015] If it is the case of drawing 5 (b), therefore, from a top the image of the 1st line and the 2nd line Only the image information of the pixel of both ends is excluded. The image of the 3rd line The image information of the pixel of eye nine trains is excluded from both ends and Hidari, the number of pixels of the image of the 4th line which the image information of the pixel of eye eight trains is excluded from both ends and Hidari, and is hereafter excluded as it goes caudad increases, and all the image information of the pixel of the 8th line and the 12th line is further excluded from a top. Since the remaining image is brought near by the center section and packed upwards, moreover, -1 line image of the 2nd line It is displayed on eye eye two trains - 15 train. -3 line image of the 4th line It is displayed on eye eye two trains - 14 train. -5 line image of the 6th line It is displayed on eye eye three trains - 14 train. -7 line image It is displayed on eye eye three trains - 13 train, -9 line image is displayed on eye eye 3 of the 8th

line trains - 13 train, -10 line image is displayed on eye eye 4 of the 9th line trains - 13 train, and -11 line image is displayed on eye eye 4 of the 10th line trains - 13 train.
The pixel which should be excluded can be chosen as arbitration at this time. However, since information important for a center section contains image information, it is usually desirable to exclude the edge of an image preferentially. Moreover, in order to prevent all the image information of a certain part being missing, it is desirable to exclude an image equally, without inclining.
[0016] In order to realize the above-mentioned amendment approach, ROM for dot amendment (read only memory) (75) which memorized the information on whether image information is excluded about each pixel like drawing 5 (b), and ROM for address amendment (76) which memorized the initiation train of each line are arranged. ROM for dot amendment (75) receives the line address signal from a line counter (73), and the train address signal from a dot counter (74), reads the corresponding data of a location, and transmits them as a write-in enabling signal. At this time, if these data are 1, the signal of H level which shows write-in authorization will be transmitted, and if data are 0, the signal of L level which shows a write inhibit will be transmitted. ROM for address amendment (76) receives the line address signal from a line counter (73), reads the initiation train address corresponding to this line address, and transmits a line address and the initiation train address to the address counter for writing (77).
[0017] The address counter for writing (77) receives the line address and the initiation train address from ROM for address amendment (76) as initial value of a counter. Moreover, the write-in clock (720) from a write-in clock generation circuit (72) and the write-in enabling signal from ROM for dot amendment (75) are received, an AND is taken, and the AND gate (78) is transmitted to the clock terminal of the address counter for writing (77). And the address counter for writing (77) transmits the write-in address to a DRAM controller (60). A DRAM controller (60) memorizes the write-in enabling signal from ROM for dot amendment (75), and the 1-pixel picture signal digitized in DRAM (6) by the storage location corresponding to the write-in address only when the write-in address from the address counter for writing (77) was received and a write-in enabling signal was H level.
[0018] The actuation when receiving the picture signal, horizontal synchronizing pulse, and vertical synchronizing pulse for one screen in the circuit of the above-mentioned configuration is explained. First, a line counter (73) is reset by reception of a vertical synchronizing pulse. Next, a line counter (73) counts by reception of a horizontal synchronizing pulse, and a dot counter (74) is reset. Moreover, based on the time of starting the display of an image after reception of a horizontal synchronizing pulse, a write-in initiation pulse forming network (71) generates a write-in initiation pulse (710), and a write-in clock generation circuit (72) receives this write-in initiation pulse (710), and starts generation of a write-in clock (720). An A/D converter (70) is sampled and digitized by the number of pixels of a request of the picture signal of the 1 scanning line (this operation gestalt 16) based on this write-in clock (720). Moreover, a dot counter (74) counts based on this write-in clock (720). ROM for address amendment (76) receives the line address signal from a line counter (73), and transmits the corresponding initiation train address of a line to the address counter for writing (77). Moreover, ROM for dot amendment (75) receives the line address signal and train address signal from a line counter (73) and a dot counter (74), respectively, from the address position to which this ROM (75) corresponds, reads the information on whether image information is excluded, and transmits a write-in enabling signal. An AND with the write-in clock (720) from a write-in clock generation circuit (72) is taken, and, as for a write-in enabling signal, the signal of this AND is transmitted to the address counter for writing (77) in the AND gate (78). The address counter for writing (77) starts a count from the line address and the initiation train address from ROM for address amendment (76), and counts it based on the signal of the AND of a write-in clock (720) and a write-in enabling signal. That is, when image information is excluded, it does not count. And a DRAM controller (60) memorizes the 1-pixel picture signal digitized by the storage location of the write-in address in DRAM (6), only when a write-in enabling signal is H level.
[0019] Next, the image which the trapezoidal distortion was amended and was memorized by DRAM (6) is explained along with drawing 4 about the circuitry for transmitting to a display

driving gear (31). A horizontal synchronizing pulse and a vertical synchronizing pulse need to be transmitted to a display driving gear (31) with a picture signal. Therefore, the display controller (80) who generates a horizontal synchronizing pulse and a vertical synchronizing pulse is stationed. Moreover, like the above, a horizontal synchronizing pulse is received, an image display initiation time is specified, and this read-out initiation pulse forming network (81) that generates a read-out initiation pulse (810), and is transmitted based on a time is arranged. Moreover, the read-out clock generation circuit (82) which generates the read-out clock (820) corresponding to the number of pixels (this operation gestalt 16) which should be read to per 1 scanning line is arranged like the above by receiving the read-out initiation pulse (810) from a read-out initiation pulse forming network (81).

[0020] In case the 1-pixel picture signal digitized from DRAM (6) is read, it is necessary to specify the line address and the train address which show a read-out location. Therefore, the line counter (83) which specifies a line address, and the dot counter (84) which specifies the train address are arranged. A line counter (83) receives the horizontal synchronizing pulse and vertical synchronizing pulse from a display controller (80) with a clock terminal and a reset terminal, respectively, and transmits a 4-bit line address signal to a DRAM controller (60). A dot counter (84) receives the read-out clock (820) from a read-out clock generation circuit (82) with a clock terminal, receives the horizontal synchronizing pulse from a display controller (80) with a reset terminal, and transmits a 4-bit train address signal to a DRAM controller (60).

[0021] A DRAM controller (60) receives said read-out clock (820), a line address signal, and a train address signal, and a 1-pixel picture signal is read from the storage location of DRAM (6) specified by a line address signal and the train address signal based on a read-out clock (820). Since the read picture signal is a digital signal, the D/A converter (85) which changes this into an analog signal is arranged. The picture signal read from DRAM (6) is changed into a D/A converter (85) by the analog signal based on a read-out clock (820), and by covering the line address of one line and repeating this, it serves as a picture signal of the 1 scanning line, and is transmitted to a display driving gear (31) with the horizontal synchronizing pulse and vertical synchronizing pulse from a display controller (80).

[0022] By constituting a trapezoidal-distortion compensator (5) as mentioned above, the image from a personal computer (4) is received, and it is made the image which amended the trapezoidal distortion beforehand, and memorizes to DRAM (6). And the image which amended the trapezoidal distortion projects on a light valve (11) like drawing 1 by reading the image amended from DRAM (6) and transmitting to a display driving gear (31) with a horizontal synchronizing pulse and a vertical synchronizing pulse. Therefore, the legible image with which the trapezoidal distortion was amended is projected on a screen (2) like drawing 1 . Thus, since this invention amends a trapezoidal distortion in the electrical circuit of a trapezoidal-distortion compensator (5), it does not need the optical system of the addition for keystone correction. Therefore, enlargement and forming an expensive rank do not have a projector (1) for keystone correction.

[0023] In addition, in order to give explanation easy, although [this operation gestalt] one screen is constituted by 12 x 16 pixels, the number of pixels which constitutes one screen can be chosen as arbitration. It is necessary to change the memory space of DRAM (6) according to the number of pixels at this time. Similarly, with this operation gestalt, although the monochrome image was explained, this is applicable also to a color picture. Since a picture signal is constituted by three picture signals, R (red), G (green), and B (blue), at this time, it is necessary to increase the memory space of DRAM (6) 3 times. Moreover, it is necessary to arrange three light valves (11) for every picture signal, to compound the beam of light which passes each light valve (11) with a well-known means, and to project on a screen (2). Similarly, with this operation gestalt, although the picture signal was made into 2 gradation, it is applicable also to the picture signal which has halftone. It is necessary to increase the quantum numbers in quantization of an A/D converter (70), and the memory space of DRAM (6) according to the number of gradation at this time.

[0024] for example, like the common VGA display of a personal computer (4) One screen is constituted by 480 x 640 pixels, and the RGB code in each pixel 6-bit 64 gradation When

receiving the picture signal which is (that is, 643** 260,000 color can be displayed) from a personal computer (4) When 23x3=24 bit is needed about each pixel and this is made into 1 word, 210x29=512K WORD (referred to as 1K=1024) is needed about one screen. Therefore, DRAM (6) whose memory space is 512K WORD x24 bit will be used in this case.

[0025] Moreover, although this operation gestalt has explained the keystone distortion of an image from the projector (1) as an extreme example [image / which is projected on a screen (2)] of distortion Even if it is the case where an optical axis from a projector (1) like drawing 7 crosses the core and perpendicular of a screen (2), the optical path length from a projector (1) The core of a screen (2) is the shortest, and since the four corners of a screen (2) become the longest, the image displayed on a screen (2) turns into the so-called image of a bobbin strain. This bobbin strain can be amended by applying this invention and displaying on a light valve (11) the image in which the image of four corners was compressed and put from the subject-copy image also about the image of this bobbin strain. Thus, this invention is applicable to distortion of the arbitration of the image projected on a screen (2).

[0026] Moreover, with this operation gestalt, ROM for dot amendment (75) and one ROM for address amendment (76) were arranged at the trapezoidal-distortion compensator (5), respectively. However, the dilation ratio of the image in each part, distortion (2), i.e., the screen, of an image, changes with geometric physical relationship of projectors (1), such as an include angle of a projector (1), the distance of a screen (2) and the optical axis from a projector (1), and the normal of a screen (2) to make, and a screen (2). Therefore, as for the equipment which amends distortion of an image, it is desirable that it has two or more ROMs for dot amendment (75) and ROM for address amendment (76) corresponding to each distortion, and can be made to carry out change use. The equipment which amends distortion of an image or instead of each ROM for amendment (75), and (76) Have RAM for dot amendment, and RAM for address amendment, and the dilation ratio of the image in each part of a screen (2) is computed from the geometric physical relationship of a projector (1) and a screen (2). It is desirable to memorize each data for amendment which created and created the data for dot amendment and the data for address amendment based on the computed dilation ratio to each RAM for amendment, respectively.

[0027] Explanation of the above-mentioned operation gestalt is for explaining this invention, and it should not be understood so that invention of a publication may be limited to a claim or the range may be ****(ed). Moreover, as for each part configuration of this invention, it is needless to say for deformation various by technical within the limits given not only in the above-mentioned operation gestalt but a claim to be possible.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In order to solve this trouble, like drawing 8 , the location of a projector (1) is arranged down [before a screen (2)], and projecting the beam of light from a projector (1) on the screen (2) located in the slanting upper part is performed. However, since an optical path becomes long rather than the beam of light with which the beam of light projected on the upper part of a screen (2) in this case was projected on the lower part of a screen (2), the image (20) reflected in a screen (2) turns into an image which the upper part was expanded and was distorted to the trapezoid like drawing 8 . Therefore, an image becomes hard to see and, occasionally there is un-arranging [which the upper part of an image protrudes from a screen (2)]. The distortion of the image on such a screen (2) originates in the dilation ratios of the image in each part of a screen (2) differing, as a result of the optical path lengths from a projector (1) differing. Therefore, what is necessary is just to make the dilation ratio of the image in each part of a screen (2) into homogeneity with a certain means, in order to amend distortion of the image on a screen (2). However, in order to perform such distortion amendment in optical system, it is necessary to add special optical system, and a miniaturization or cheap-izing of a projector (1) becomes difficult.

[0004]

[Objects of the Invention] The image distorted to said trapezoid can display the image as the time of arranging a projector in the center section with it on a screen (2) like drawing 1 . [same if the image itself displayed on a light valve (11) is amended beforehand] Namely, about the subject-copy image displayed on a light valve (11), since the image which reversed the upper and lower sides and right and left is displayed on a screen (2), the image of a light valve (11) should just display the image which compressed the subject-copy image and was made small on a light valve (11) as it goes below. This invention aims at offering the approach and equipment which amend distortion of the image on a screen (2), without adding optical system by displaying the image amended beforehand on a light valve (11).

[0005]

[The approach for solving a technical problem] In order to solve the above-mentioned technical problem, the approach of this invention which amends distortion of a projector projection image It is related with each pixel in a light valve so that the dilation ratio of an image may become uniform in each part of a screen. The pixel from which image information is excluded, and the pixel as which the remaining image information is packed and displayed are memorized beforehand, said image information of a pixel excluded is excluded from a subject-copy image, and the remaining image is displayed in said pixel in a light valve displayed.

[Translation done.]

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OPERATION

[Function] A subject-copy image will be compressed by excluding the image information of a pixel which should be excluded from a subject-copy image, packing the remaining image and being displayed on a light valve by the above-mentioned approach. therefore, when the image on a screen is distorted to a trapezoid by having arranged the projector (1) in the lower part like drawing 8 When the pixel from which image information should be excluded, and the pixel which the remaining image information should be packed and should be displayed on a light valve (11) are memorized so that a subject-copy image may be compressed as it goes below, like drawing 1 The image displayed on a light valve (11) turns into an image compressed as it went caudad, and an image to which the subject-copy image was expanded as it was is displayed on a screen (2).

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a mimetic diagram for explaining the amendment approach of this invention.
[Drawing 2] It is the block diagram showing the operation gestalt of this invention.
[Drawing 3] In this operation gestalt, it is the block diagram showing a circuit until it amends and memorizes the image data which received.
[Drawing 4] In this operation gestalt, it is the block diagram showing a circuit until it transmits the image data amended and memorized to a display driving gear.
[Drawing 5] It is a mimetic diagram for explaining the example of amendment by this invention, and (a) is a subject-copy image and (c) is [(b) shows whether each pixel is excluded and] an image after amendment.
[Drawing 6] It is a timing diagram for explaining the write-in initiation pulse forming network and read-out initiation pulse forming network in drawing 3 and drawing 4 .
[Drawing 7] It is a mimetic diagram for explaining the usual front projection display.
[Drawing 8] It is a mimetic diagram for explaining a projection display [need / a trapezoid image / to be amended].
[Description of Notations]
(1) Projector
(2) Screen
(5) Trapezoidal-distortion compensator
(10) Light source
(11) Light valve
(12) Optical system

[Translation done.]

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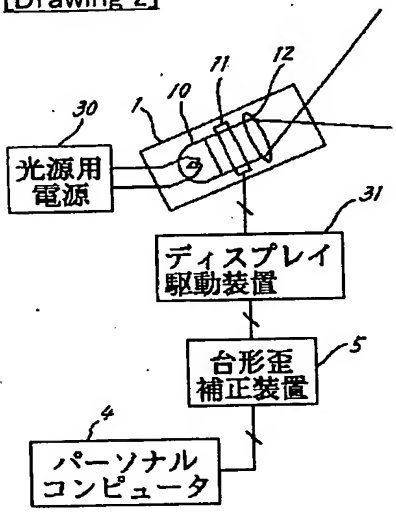
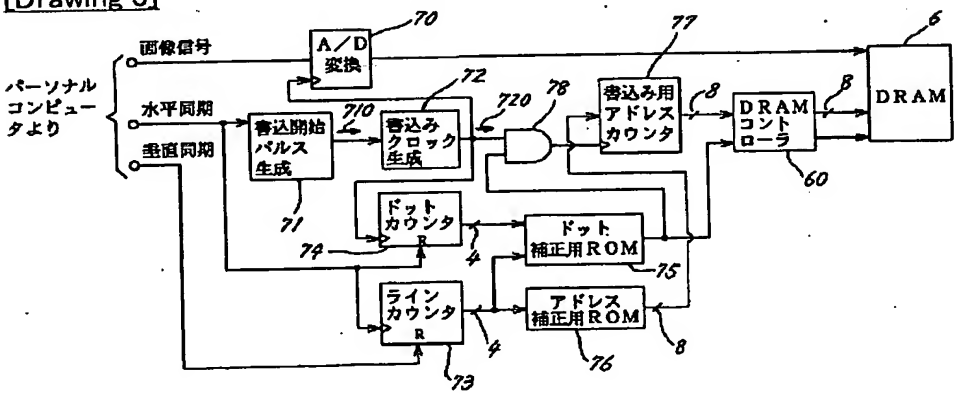
DRAWINGS

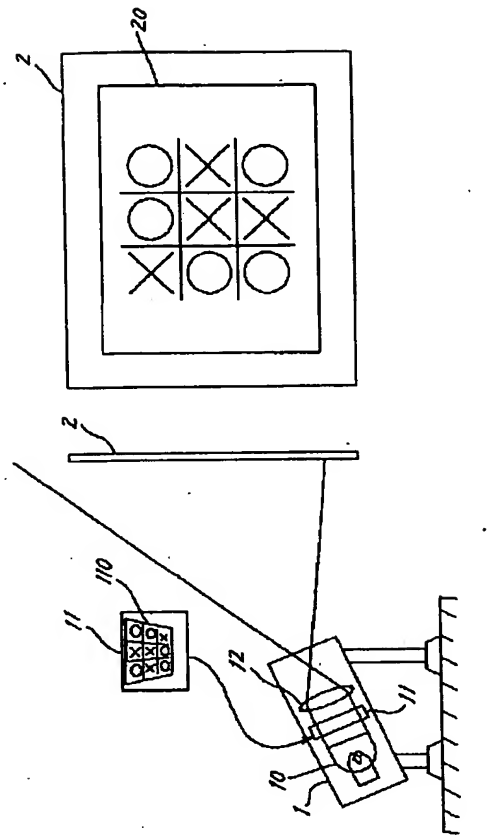
[Drawing 2]



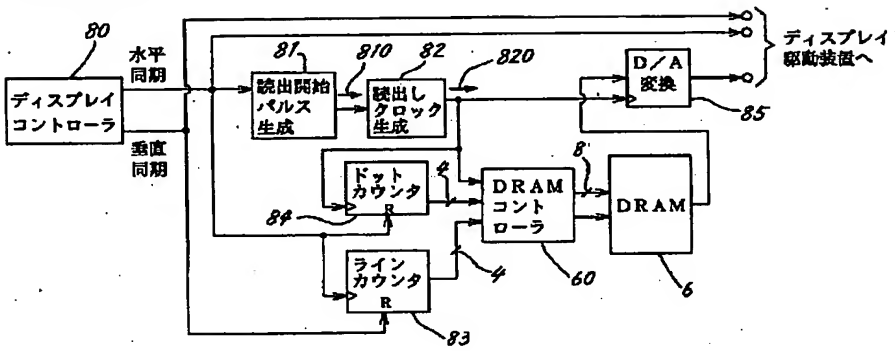
[Drawing 3]



[Drawing 1]

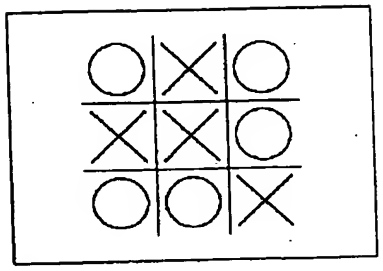


[Drawing 4]

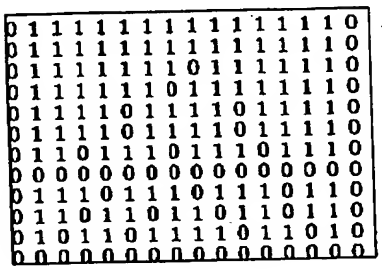


[Drawing 5]

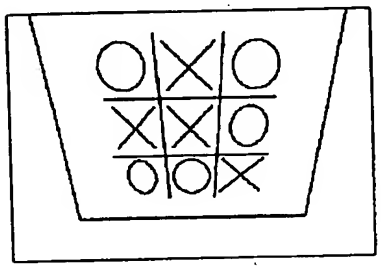
(a)



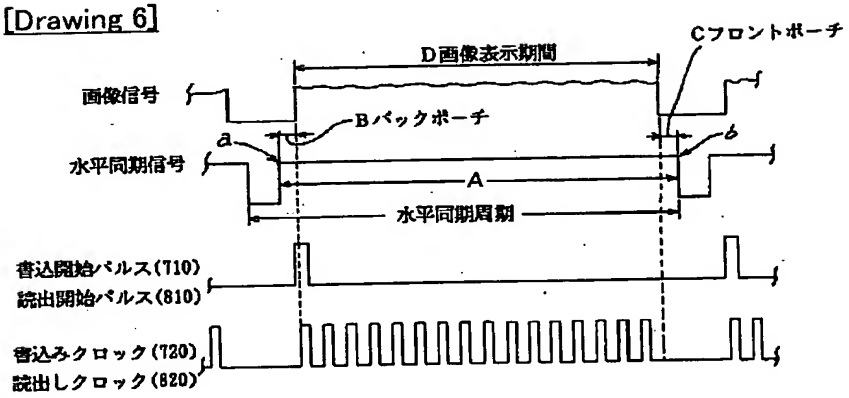
(b)



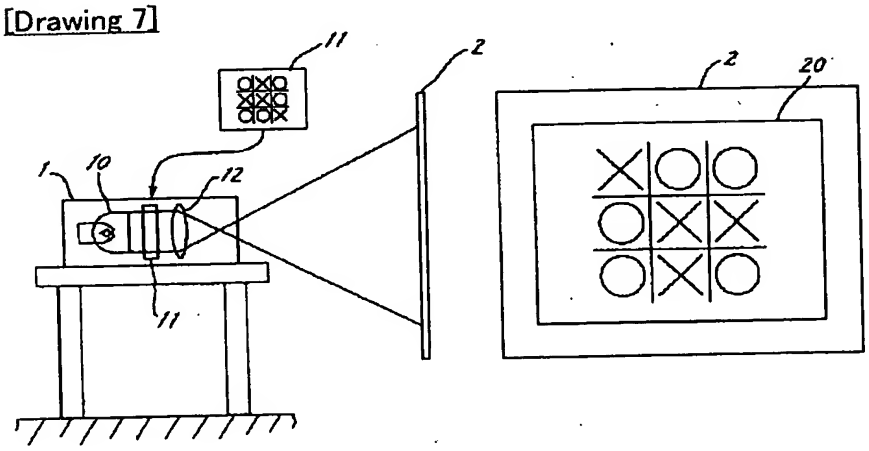
(c)



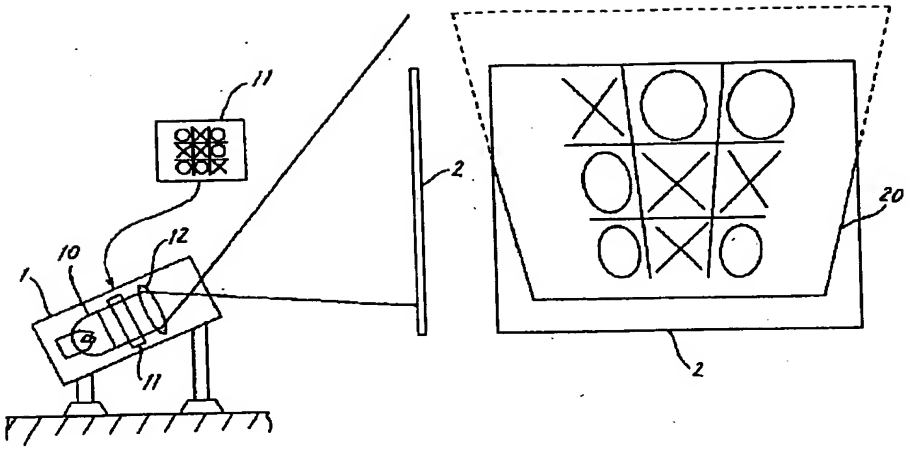
[Drawing 6]



[Drawing 7]



[Drawing 8]



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(71)出願人　000134109
株式会社デジタル
大阪府大阪市住之江区南港東８丁目２番52号

(72)発明者　前川　俊行
大阪府大阪市住之江区南港東８丁目２番52号　株式会社デジタル内

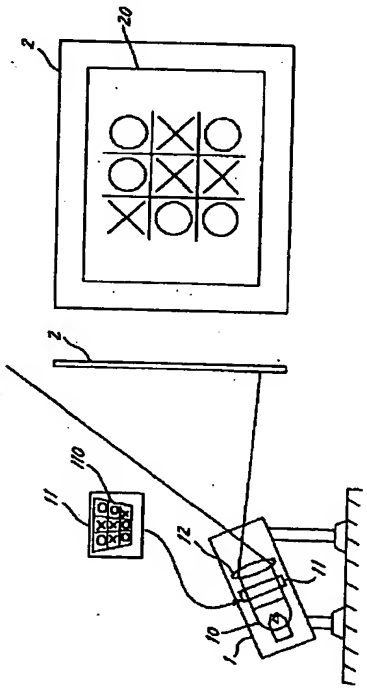
(74)代理人　弁理士　丸山　敏之　（外２名）

(54)【発明の名称】　プロジェクタ投影像の歪みを補正する方法及びプロジェクタ

(57)【要約】

【課題】　投写型ディスプレイにおいて、光学系を追加することなく、スクリーンに投影される画像の歪みを補正する。

【解決手段】　ライトバルブ11に表示された画像110をスクリーン２に拡大表示するプロジェクタ１に於て、画像20の拡大率がスクリーン２の各部で均一となるように、ライトバルブ11における各画素に関して、画像情報が省かれる画素と、残りの画像情報が詰められて表示される画素とを予め記憶しておき、前記省かれる画素の画像情報を原画像から省き、ライトバルブ11における前記表示される画素において残りの画像を表示する。



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【特許請求の範囲】

【請求項１】　ライトバルブ(11)に表示された画像(110)をスクリーン(２)に拡大表示するプロジェクタ(１)に於て、

画像(20)の拡大率がスクリーン(２)の各部で均一となるように、ライトバルブ(11)における各画素に関して、画像情報が省かれる画素と、残りの画像情報が詰められて表示される画素とを予め記憶しておき、

前記省かれる画素の画像情報を原画像から省き、ライトバルブ(11)における前記表示される画素において残りの画像を表示する、

プロジェクタ投影像の歪みを補正する方法。

【請求項２】　ライトバルブ(11)に表示された画像(110)をスクリーン(２)に拡大表示するプロジェクタ(１)に於て、

画像(20)の拡大率がスクリーン(２)の各部で均一となるように、ライトバルブ(11)における各画素に関して、画像情報が省かれる画素、及び、残りの画像情報が詰められて表示される画素を予め記憶する手段と、

該記憶する手段から読み出した前記省かれる画素にある画像情報を、原画像から省く手段と、

該省く手段によって省かれずに残った画像を、前記記憶する手段から読み出したライトバルブ(11)における前記表示される画素に表示する手段とを具えるプロジェクタ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、コンピュータ等からの画像データを大型スクリーンに投影するためのプロジェクタに関するものである。具体的には、本発明は、プロジェクタが投影する画像の歪みを補正する方法及びプロジェクタ装置に関する。

【０００２】

【従来の技術】プロジェクタ(１)は、図７のように、メタルハライドランプ等の光源(10)から投写された光線が、液晶パネル等のライトバルブ(11)を通過または反射して、光学レンズ等の光学系(12)を介して拡大されることにより、ライトバルブ(11)に表示された画像をスクリーン(２)に拡大表示する。画像の拡大率がスクリーン(２)の各部で略均一にするため、プロジェクタ(１)の光軸がスクリーン(２)の中心と垂直に交わるように、プロジェクタ(１)はスクリーン(２)に対して配置される。しかしながら、前面投写型のプロジェクタ(１)は、スクリーン(２)手前の中央部付近に配備されることになり、スクリーン(２)の像を見るのに邪魔となる。

【０００３】

【発明が解決しようとする課題】この問題点を解決するために、図８のように、プロジェクタ(１)の位置をスクリーン(２)の手前の下方に配備し、プロジェクタ(１)からの光線を、斜め上方に位置するスクリーン(２)に投影

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することが行なわれている。しかしながら、この場合、スクリーン(２)の上部に投影された光線は、スクリーン(２)の下部に投影された光線よりも光路が長くなるから、スクリーン(２)に映る画像(20)は、図８のように、上部が拡大され台形に歪んだ画像となる。従って、画像が見難くなり、ときには、画像の上部がスクリーン(２)からはみ出す不都合がある。このようなスクリーン(２)上での画像の歪みは、プロジェクタ(１)からの光路長が異なる結果、スクリーン(２)の各部における画像の拡大率が異なることに起因する。従って、スクリーン(２)上での画像の歪みを補正するには、なんらかの手段にて、スクリーン(２)の各部における画像の拡大率を均一にすればよい。しかしながら、このような歪み補正を光学系にて行なうには、特殊な光学系を追加する必要があり、プロジェクタ(１)の小型化または廉価化が困難となる。

【０００４】

【発明の目的】前記台形に歪んだ画像は、図１のように、ライトバルブ(11)に表示する画像自体が、予め補正されておれば、プロジェクタを中央部に配備したときと同様の画像をスクリーン(２)上に表示できる。即ち、ライトバルブ(11)の画像は、その上下及び左右を反転した画像がスクリーン(２)上に表示されるから、ライトバルブ(11)に表示される原画像に関して、下方へ向かうに従って原画像を圧縮して小さくした画像をライトバルブ(11)に表示すればよい。本発明は、予め補正した画像をライトバルブ(11)に表示することにより、光学系を追加することなく、スクリーン(２)上での画像の歪みを補正する方法及び装置を提供することを目的とする。

【０００５】

【課題を解決する為の方法】上記課題を解決するため、プロジェクタ投影像の歪みを補正する本発明の方法は、画像の拡大率がスクリーンの各部で均一となるように、ライトバルブにおける各画素に関して、画像情報が省かれる画素と、残りの画像情報が詰められて表示される画素とを予め記憶しておき、前記省かれる画素の画像情報を原画像から省き、ライトバルブにおける前記表示される画素において残りの画像を表示する。

【０００６】

【作用】上記方法により、省かれるべき画素の画像情報が原画像から省かれ、残った画像が詰められてライトバルブに表示されることにより、原画像が圧縮されることになる。従って、図８のように、プロジェクタ(１)を下部に配備したことによってスクリーン上の画像が台形に歪む場合には、下方へ向かうにつれて原画像が圧縮されるように、画像情報が省かれるべき画素と、残りの画像情報が詰められてライトバルブ(11)に表示されるべき画素とを記憶しておくと、図１のように、ライトバルブ(11)に表示する画像は、下方に向かうにつれて圧縮された画像となり、スクリーン(２)上には、原画像をそのまま拡大したような画像が表示される。

【０００７】
【発明の効果】本発明は、画像の歪み補正を電気回路にて行なうから、歪み補正のための追加の光学系を必要としない。従って、画像の歪み補正のためにプロジェクタが大型化及び高価格化することはない。
【０００８】
【発明の実施の形態】以下、本発明の実施形態について、図面に沿って詳述する。プロジェクタ（１）は、図１のように、メタルハライドランプの光源(10)から投写された光線が、透過型液晶パネルによって構成されるライトバルブ(11)を通過し、光学レンズによって構成される光学系(12)を介して拡大されることにより、ライトバルブ(11)上の画像をスクリーン（２）に拡大表示する。該プロジェクタ（１）には、図２のように、光源(10)を点灯させる光源用電源(30)が接続される。また、ライトバルブ(11)には、受信した水平同期パルス、垂直同期パルス及び画像信号に基づいてライトバルブ(11)を駆動し、ライトバルブ(11)に画像を表示させるディスプレイ駆動装置(31)が接続される。ディスプレイ駆動装置(31)には、スクリーン（２）上に表示される画像の台形歪みを補正するために、パーソナルコンピュータ（４）からの画像信号を補正し、補正した画像信号をディスプレイ駆動装置(31)に送信する台形歪補正装置（５）が接続される。
【０００９】前記台形歪補正装置（５）の回路構成について、図３及び図４に沿って説明する。本実施形態における台形歪補正装置（５）は、図３のように、パーソナルコンピュータ（４）からの画像信号を補正して、補正した画像信号をＤＲＡＭ（ダイナミックランダムアクセスメモリ）（６）に記憶しておき、図４のように、記憶した画像信号をＤＲＡＭ(６)から読み出してディスプレイ駆動装置(31)に送信する装置である。
【００１０】まず、パーソナルコンピュータ（４）から画像信号、水平同期パルス及び垂直同期パルスを受信する。パーソナルコンピュータ（４）からの画像信号は、アナログ信号であり、水平同期期間内に１走査線の画像信号が送信され、これを垂直同期期間内に繰り返すことにより、１画面の画像信号が送信される。画像信号を補正してＤＲＡＭ(６)に記憶するため、アナログの画像信号をデジタル信号に変換するＡ／Ｄ変換器(70)が、台形歪補正装置（５）に配備される。
【００１１】Ａ／Ｄ変換器(70)は、標本化により１走査線の画像信号を一定時間間隔で測定し、この測定値を数値に変換する量子化を行ない、最後に、この量子化された数値を２進数に変換する符号化によりアナログ信号のデジタル化が行なわれる。しかしながら、１走査線の画像信号は、図６のように、水平同期パルスのパルスセパレーションＡの全期間中に送信されるのではなく、パルスセパレーションＡの開始時点ａから所定期間Ｂ（バックポーチと呼ばれる）を経過した時点から送信が開始され、パルスセパレーションＡの終了時点ｂより所定期間Ｃ（フロントポーチと呼ばれる）だけ前の時点で送信が終了される。従って、Ａ／Ｄ変換器(70)は、水平同期パルスのパルスセパレーションＡからフロントポーチＢ及びバックポーチＣを除いた画像表示期間Ｄに画像信号を標本化する必要がある。
【００１２】そこで、図３において、書込開始パルス生成回路(71)は、水平同期パルスを受信して画像表示開始時点を特定し、該時点に基づいて書込開始パルス(710)を生成して、書込みクロック生成回路(72)に送信する。書込みクロック生成回路(72)は、前記書込開始パルス(710)を受信して、１走査線の画像信号が、ライトバルブ(11)の所望の画素数（本実施例では１走査線当り16画素）に標本化により分割されるような書込みクロック(720)を生成する。Ａ／Ｄ変換器(70)は、前記書込みクロック生成回路(72)からの書込みクロック(720)をクロック端子にて受信し、該書込みクロック(720)に基づいて画像信号がデジタル化され、デジタル化された画像信号がＤＲＡＭ(６)に送信される。
【００１３】デジタル画像信号をＤＲＡＭ(６)に書き込む際には、書込み位置を示すアドレスを特定する必要がある。本実施形態では、パーソナルコンピュータ（４）からの画像は、モノクロ２階調であり、１走査線当り16個の画素に分割され、１画面が12本の走査線によって構成されている場合について行なう。このとき、Ａ／Ｄ変換器(70)により、各画素の画像情報は１ビットのデジタル信号によって表現されるから、ＤＲＡＭ(６)に必要な記憶容量は16×12×１＝192ビットとなる。また、１画面の画素の位置は、１画面内の走査線位置を特定する４ビットの行アドレスと、１走査線内の画素位置を特定する４ビットの列アドレスによって特定される。行アドレスを特定するためにラインカウンタ(73)が配備される。ラインカウンタ(73)は、水平同期パルスをクロック端子にて受信し、垂直同期パルスをリセット端子にて受信して、４ビットの行アドレス信号を送信する。また、列アドレスを特定するためにドットカウンタ(74)が配備される。ドットカウンタ(74)は、書込みクロック生成回路(72)からの書込みクロック(720)をクロック端子にて受信し、水平同期パルスをリセット端子にて受信して、４ビットの列アドレス信号を送信する。もし、画像の歪みを補正しないで、ライトバルブ(11)上の画像をそのままスクリーン（２）へ投影するならば、ラインカウンタ(73)及びドットカウンタ(74)からの行アドレス信号及び列アドレス信号をＤＲＡＭコントローラ(60)が受信して、ＤＲＡＭ(６)における受信した行アドレス及び列アドレスにデジタル画像信号を書き込めばよい。
【００１４】本実施形態において画像の台形歪を補正する方法は、以下のとおりである。図８のような画像(20)の台形歪を補正するには、スクリーン（２）に表示する画像に関して、上方へ向かうにつれて画像を圧縮すればよい。従って、ライトバルブ(11)に表示する画像(110)

は、図５（ａ）のような原画像が、図５（ｃ）のように、下方に向かうにつれて画像を中央部へ圧縮した画像とすればよい。これをデジタル信号にて実現するには、図５（ｂ）のように、水平方向に関しては、画像情報を画素単位で適当に省き、下方のラインほど省く割合を大きくし、残った画像を中央部へ寄せればよく、垂直方向に関しては、圧縮率を高くする必要がある下方にて、あるラインの画像情報全てを省いて、残ったラインを上方へ詰めればよい。なお、図５（ｂ）において、数字の記載位置は各画素を示し、数値が０のものは、その位置の画素の画像情報が省かれることを示している。

【００１５】従って、図５（ｂ）の場合であれば、上から１行目及び２行目の画像は、両端の画素の画像情報のみが省かれ、３行目の画像は、両端と左から９列目の画素の画像情報が省かれ、４行目の画像は、両端と左から８列目の画素の画像情報が省かれ、以下、下方に向かうにつれて省かれる画素数が増えてゆき、さらに、上から８行目及び12行目の画素の画像情報は全て省かれる。また、残った画像は中央部へ寄せられ且つ上方へ詰められるから、

・１行目及び２行目の画像は、２列目～15列目に表示され、

・３行目及び４行目の画像は、２列目～14列目に表示され、

・５行目及び６行目の画像は、３列目～14列目に表示され、

・７行目の画像は、３列目～13列目に表示され、

・９行目の画像は、８行目の３列目～13列目に表示され、

・10行目の画像は、９行目の４列目～13列目に表示され、

・11行目の画像は、10行目の４列目～13列目に表示される。

このとき、省かれるべき画素は任意に選択できる。しかしながら、通常、画像情報は中央部に重要な情報が含んでいるから、画像の端部が優先的に省かれることが望ましい。また、ある部分の画像情報が全て欠落することを防ぐため、偏ることなく均等に画像が省かれることが望ましい。

【００１６】上記補正方法を実現するため、図５（ｂ）のような、各画素について画像情報を省くか否かの情報を記憶したドット補正用ＲＯＭ（リードオンリーメモリ）（75）と、各行の開始列を記憶したアドレス補正用ＲＯＭ(76)とが配備される。ドット補正用ＲＯＭ(75)は、ラインカウンタ(73)からの行アドレス信号と、ドットカウンタ(74)からの列アドレス信号とを受信して、対応する位置のデータを読み出して書込み許可信号として送信する。このとき、該データが１であれば書込み許可を示すＨレベルの信号を送信し、データが０であれば書込み禁止を示すＬレベルの信号を送信する。アドレス補正用ＲＯＭ(76)は、ラインカウンタ(73)からの行アドレス信号を受信し、該行アドレスに対応する開始列アドレスを読み出して、行アドレス及び開始列アドレスを書込み用アドレスカウンタ(77)に送信する。

【００１７】書込み用アドレスカウンタ(77)は、アドレス補正用ＲＯＭ(76)からの行アドレス及び開始列アドレスをカウンタの初期値として受信する。また、ＡＮＤゲート(78)は、書込みクロック生成回路(72)からの書込みクロック(720)と、ドット補正用ＲＯＭ(75)からの書込み許可信号とを受信し、論理積が取られて、書込み用アドレスカウンタ(77)のクロック端子に送信する。そして、書込み用アドレスカウンタ(77)は、書込みアドレスをＤＲＡＭコントローラ(60)に送信する。ＤＲＡＭコントローラ(60)は、ドット補正用ＲＯＭ(75)からの書込み許可信号と、書込み用アドレスカウンタ(77)からの書込みアドレスを受信し、書込み許可信号がＨレベルのときのみ、ＤＲＡＭ(６)において書込みアドレスに対応する記憶位置にデジタル化された１画素の画像信号を記憶する。

【００１８】上記構成の回路に１画面分の画像信号、水平同期パルス及び垂直同期パルスを受信するときの動作について説明する。まず、垂直同期パルスの受信によりラインカウンタ(73)がリセットされる。次に、水平同期パルスの受信によりラインカウンタ(73)がカウントされ、ドットカウンタ(74)がリセットされる。また、水平同期パルスの受信後に画像の表示を開始する時点に基づいて、書込開始パルス生成回路(71)は書込開始パルス(710)を生成し、書込みクロック生成回路(72)は、該書込開始パルス(710)を受信して書込みクロック(720)の生成を開始する。該書込みクロック(720)に基づいて、Ａ／Ｄ変換器(70)は、１走査線の画像信号を所望の画素数（本実施形態では16）に標本化され、デジタル化される。また、該書込みクロック(720)に基づいてドットカウンタ(74)がカウントされる。アドレス補正用ＲＯＭ(76)は、ラインカウンタ(73)からの行アドレス信号を受信して、対応する行の開始列アドレスを書込み用アドレスカウンタ(77)に送信する。また、ドット補正用ＲＯＭ(75)は、ラインカウンタ(73)及びドットカウンタ(74)からの行アドレス信号及び列アドレス信号をそれぞれ受信して、該ＲＯＭ(75)の対応するアドレス位置から、画像情報を省くか否かの情報を読み出して、書込み許可信号を送信する。書込み許可信号は、ＡＮＤゲート(78)にて、書込みクロック生成回路(72)からの書込みクロック(720)との論理積が取られて、該論理積の信号が書込み用アドレスカウンタ(77)に送信される。書込み用アドレスカウンタ(77)は、アドレス補正用ＲＯＭ(76)からの行アドレス及び開始列アドレスからカウントを開始し、書込みクロック(720)と書込み許可信号との論理積の信号に基づいてカウントする。即ち、画像情報が省かれるときにはカウントしない。そして、ＤＲＡＭコントローラ(60)

は、書込み許可信号がＨレベルのときのみ、ＤＲＡＭ(６)における書込みアドレスの記憶位置にデジタル化された１画素の画像信号を記憶する。

【００１９】次に、台形歪が補正されてＤＲＡＭ(６)に記憶された画像を、ディスプレイ駆動装置(31)に送信するための回路構成について、図４に沿って説明する。ディスプレイ駆動装置(31)には、画像信号と共に水平同期パルス及び垂直同期パルスが送信される必要がある。従って、水平同期パルス及び垂直同期パルスを生成するディスプレイコントローラ(80)が配備される。また、上記と同様に、水平同期パルスを受信して画像表示開始時点を特定し、該時点に基づいて読出開始パルス(810)を生成し且つ送信する読出開始パルス生成回路(81)が配備される。また、上記と同様に、読出開始パルス生成回路(81)からの読出開始パルス(810)を受信することにより、１走査線当りに読み出すべき画素数（本実施形態では16）に対応する読出しクロック(820)を生成する読出しクロック生成回路(82)が配備される。

【００２０】ＤＲＡＭ(６)からデジタル化された１画素の画像信号を読み出す際には、読出し位置を示す行アドレス及び列アドレスを特定する必要がある。従って、行アドレスを特定するラインカウンタ(83)と、列アドレスを特定するドットカウンタ(84)が配備される。ラインカウンタ(83)は、ディスプレイコントローラ(80)からの水平同期パルス及び垂直同期パルスを夫々クロック端子及びリセット端子にて受信して、４ビットの行アドレス信号をＤＲＡＭコントローラ(60)に送信する。ドットカウンタ(84)は、読出しクロック生成回路(82)からの読出しクロック(820)をクロック端子にて受信し、ディスプレイコントローラ(80)からの水平同期パルスをリセット端子にて受信して、４ビットの列アドレス信号をＤＲＡＭコントローラ(60)に送信する。

【００２１】ＤＲＡＭコントローラ(60)は、前記読出しクロック(820)、行アドレス信号及び列アドレス信号を受信し、行アドレス信号及び列アドレス信号によって特定されるＤＲＡＭ(６)の記憶位置から読出しクロック(820)に基づいて１画素の画像信号が読み出される。読み出された画像信号はデジタル信号であるから、これをアナログ信号に変換するＤ／Ａ変換器(85)が配備される。Ｄ／Ａ変換器(85)は、ＤＲＡＭ(６)から読み出された画像信号を読出しクロック(820)に基づいてアナログ信号に変換され、これを行アドレス１行に亘って繰り返すことにより１走査線の画像信号となって、ディスプレイコントローラ(80)からの水平同期パルス及び垂直同期パルスと共にディスプレイ駆動装置(31)に送信される。

【００２２】上記のように台形歪補正装置(５)を構成することにより、パーソナルコンピュータ(４)からの画像を受信して、予め台形歪を補正した画像にしてＤＲＡＭ(６)に記憶しておく。そして、ＤＲＡＭ(６)から補正した画像を読み出して、水平同期パルス及び垂直同期パルスと共にディスプレイ駆動装置(31)に送信することにより、図１のように、ライトバルブ(11)に台形歪を補正した画像が映し出される。従って、スクリーン(２)には、図１のように、台形歪が補正された見やすい画像が投影される。このように、本発明は、台形歪補正装置(５)の電気回路において台形歪の補正を行なうから、台形補正のための追加の光学系を必要としない。従って、台形補正のためにプロジェクタ(１)が大型化及び高価格化することはない。

【００２３】なお、本実施形態では、説明を容易にするために、横16×縦12画素によって１画面が構成されるとしたが、１画面を構成する画素数は任意に選択できる。このとき、画素数に応じてＤＲＡＭ(６)のメモリ容量を変更する必要がある。同様に、本実施形態では、モノクロ画像について説明したが、これをカラー画像にも適用できる。このとき、画像信号は、Ｒ（赤）、Ｇ（緑）及びＢ（青）の３つの画像信号によって構成されるから、ＤＲＡＭ(６)のメモリ容量を３倍にする必要がある。また、各画像信号毎に３つのライトバルブ(11)を配備して、公知手段にて各ライトバルブ(11)を通過する光線を合成してスクリーン(２)に投影する必要がある。同様に、本実施形態では、画像信号を２階調としたが、中間調を有する画像信号にも適用できる。このとき、Ａ／Ｄ変換器(70)の量子化における量子数と、ＤＲＡＭ(６)のメモリ容量を階調数に応じて増やす必要がある。

【００２４】例えば、一般的なパーソナルコンピュータ(４)のＶＧＡディスプレイのように、１画面が横640×縦480画素によって構成され、各画素におけるＲＧＢ信号が６ビット64階調（即ち、64^3≒26万色が表示可能）である画像信号をパーソナルコンピュータ(４)から受信する場合は、各画素について2^3×３＝24ビットが必要となり、これを１ワードとすると、１画面について2^{10}×2^9＝512Ｋワード（１Ｋ＝1024とする）が必要となる。従って、この場合、メモリ容量が512Ｋワード×24ビットであるＤＲＡＭ(６)が使用されることになる。

【００２５】また、本実施形態では、プロジェクタ(１)からスクリーン(２)に投影される画像の歪みの極端な例として、画像の台形歪みに関して説明してきたが、図７のような、プロジェクタ(１)からの光軸がスクリーン(２)の中心と垂直に交わる場合であっても、プロジェクタ(１)からの光路長は、スクリーン(２)の中心部が最も短く、スクリーン(２)の四隅が最も長くなるから、スクリーン(２)に表示される画像は、いわゆる糸巻ひずみの画像となる。この糸巻ひずみの画像に関しても、本発明を適用し、原画像から四隅の画像を圧縮して詰めた画像をライトバルブ(11)に表示させることにより、該糸巻ひずみを補正できる。このように、本発明は、スクリーン(２)に投影される画像の任意の歪みに対して適用できる。

【００２６】また、本実施形態では、台形歪補正装置

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(5)に、ドット補正用ＲＯＭ(75)及びアドレス補正用ＲＯＭ(76)をそれぞれ１つ配備した。しかしながら、プロジェクタ(1)とスクリーン(2)の距離、プロジェクタ(1)からの光軸とスクリーン(2)の法線とのなす角度等、プロジェクタ(1)とスクリーン(2)の幾何学的な位置関係によって、画像の歪みすなわちスクリーン(2)の各部における画像の拡大率が異なる。従って、画像の歪みを補正する装置は、夫々の歪みに対応する複数のドット補正用ＲＯＭ(75)及びアドレス補正用ＲＯＭ(76)を具えて、切替使用できるようにすることが望ましい。或いは、画像の歪みを補正する装置は、各補正用ＲＯＭ(75)(76)の代りに、ドット補正用ＲＡＭ及びアドレス補正用ＲＡＭを具えて、プロジェクタ(1)とスクリーン(2)の幾何学的な位置関係からスクリーン(2)の各部における画像の拡大率を算出し、算出した拡大率に基づいてドット補正用データ及びアドレス補正用データを作成し、作成した各補正用データを各補正用ＲＡＭにそれぞれ記憶するようにすることが望ましい。

【００２７】上記実施形態の説明は、本発明を説明するためのものであって、特許請求の範囲に記載の発明を限定し、或は範囲を減縮する様に解すべきではない。又、本発明の各部構成は上記実施形態に限らず、特許請求の範囲に記載の技術的範囲内で種々の変形が可能であることは勿論である。

【図面の簡単な説明】

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【図１】本発明の補正方法を説明するための模式図である。

【図２】本発明の実施形態を示すブロック図である。

【図３】本実施形態において、受信した画像データを補正して記憶するまでの回路を示すブロック図である。

【図４】本実施形態において、補正して記憶した画像データをディスプレイ駆動装置へ送信するまでの回路を示すブロック図である。

【図５】本発明による補正例を説明するための模式図であり、（ａ）は原画像であり、（ｂ）は各画素が省かれるか否かを示し、（ｃ）は補正後の画像である。

【図６】図３及び図４における書込開始パルス生成回路及び読出開始パルス生成回路を説明するためのタイムチャートである。

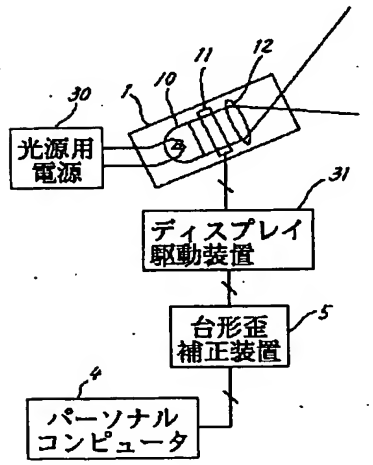
【図７】通常の前面投写型ディスプレイを説明するための模式図である。

【図８】台形画像の補正が必要な投写型ディスプレイを説明するための模式図である。

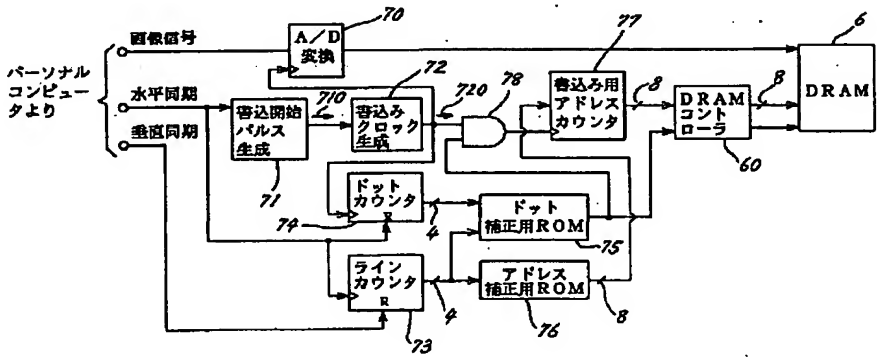
【符号の説明】

20
（１）　プロジェクタ
（２）　スクリーン
（５）　台形歪補正装置
(10)　光源
(11)　ライトバルブ
(12)　光学系

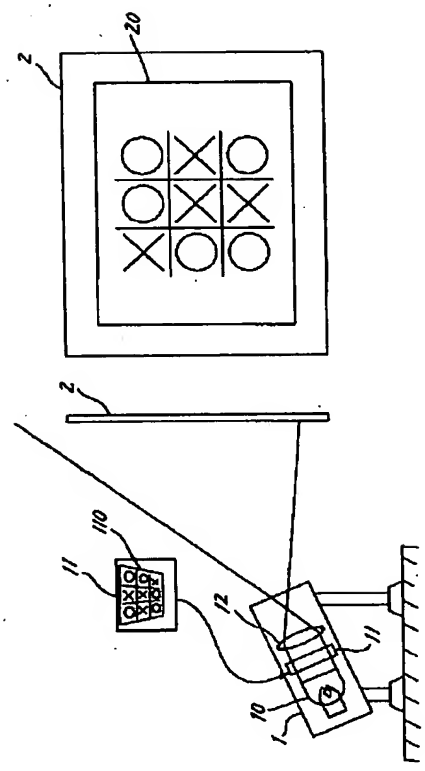
【図２】



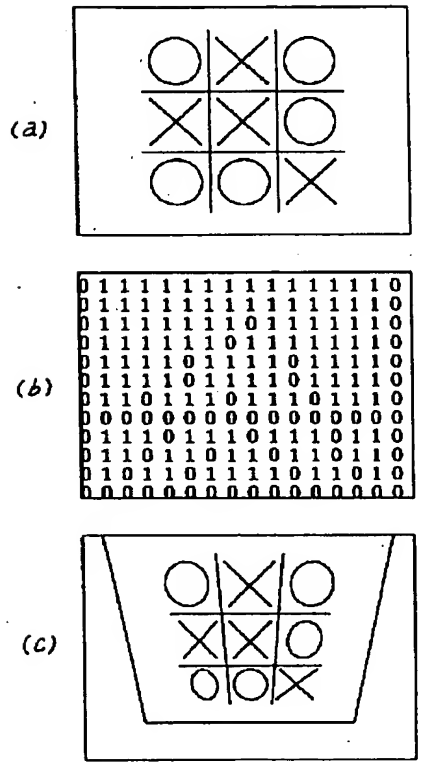
【図３】



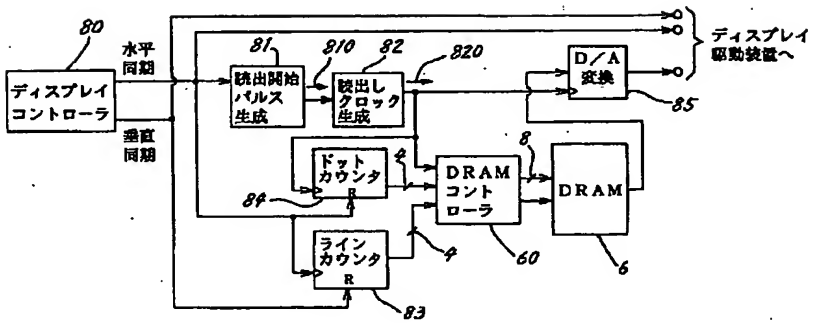
【図１】


20
2
2
110
11
12
11
10
1

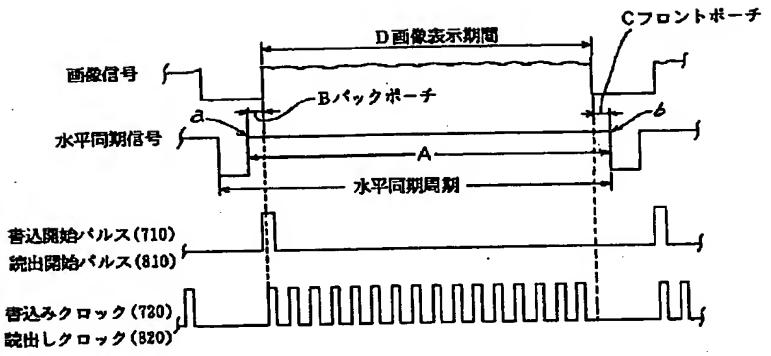
【図５】


(a)
(b)
(c)

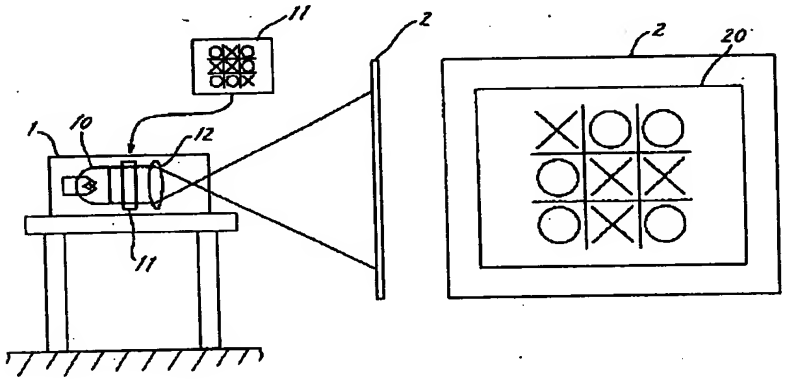
【図４】


80
ディスプレイ
コントローラ
水平
同期
垂直
同期
81
読出開始
パルス
生成
810
82
読出し
クロック
生成
820
D／A
変換
ディスプレイ
駆動装置へ
85
8
ドット
カウンタ
R
84
DRAM
コント
ローラ
DRAM
4
60
6
ライン
カウンタ
R
83

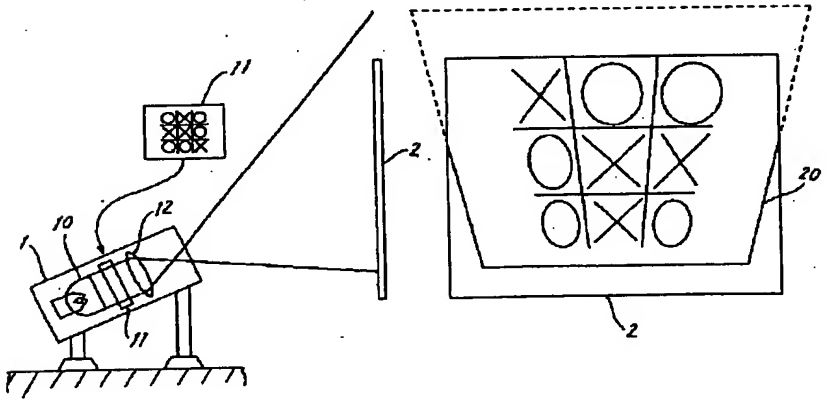
【図６】


D画像表示期間
Cフロントポーチ
画像信号
Bバックポーチ
a
b
水平同期信号
A
水平同期周期
書込開始パルス(710)
読出開始パルス(810)
書込みクロック(720)
読出しクロック(820)

【図７】


11
2
2
20
1
10
12
11

【図８】


11
2
20
1
10
12
11
2